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Commentary

Geology, Asbestos, and Health

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A brief discussion of three types of geologic occurences of asbestos-like minerals is given. The problem of mining ore free of asbestos is considered.

Amphiboles, some of which are classified as asbestos, are major rock-forming minerals and are being intensively studied in order to learn more about geologic processes. Now that these minerals have become important for other reasons - health, these studies take on added importance.

I will mention briefly three typical amphibole deposits and how they might relate to this whole problem of asbestos and health.

A study of the amphiboles from the metamorphosed Ruby Mountain iron formation, Montana, was made about 6 years ago during an investigation of the actinolite–cummingtonite associations. These minerals crystallize at 500–600°C under moderately high pressures, and as they cool they precipitate in the solid state (unmix) a second amphibole (actinolite precipitates cummingtonite which appears as lamellae). This phenomenon is very typical of amphiboles from iron formations. We have found the same type of "unmixed" amphibole in certain water samples from Lake Superior. This suggests that at least some amphibole in these waters may have come from rocks similar to those of the Ruby Mountain area.

The talc mining area of Gouverneur, New York offers a good example of a complex association of amphiboles, talc, and their alteration products. The rocks of the Gouverneur metamorphic belt were first formed by precipitation of calcium and magnesium carbonates along with silica in a Precambrian sea, then buried and metamorphosed to temperatures as high as 450–550°C and at pressures perhaps as great as 5 kbars. The metamorphosed sediments are highly complex mineralogically, with different mineral assemblages interfingering within relatively small volumes of rock. Walking across the bottom of an open pit talc mine, for example the Arnold Pit, you cross from foot wall dolomite into the amphibolite rock, which at first may consist of perhaps 30 ft of limy talc rock (a fine-grained talc rock containing carbonates and anthophyllite or serpentine alteration), then several feet of scale (a nearly pure coarsely crystalline talc containing about 1% tromolite), then perhaps 100 ft of massive talc ore (talc + anthophyllite + tremolite + serpentine), then a sequence of irregular interbedding of coarsely crystalline tremolite and massive talc ore (perhaps 100–200 ft), and finally the hanging wall dolomite. The mineralogy of these deposits is complicated even more by very recent low temperature alteration of the primary silicates, diopside, tremolite, cummingtonite, and talc, to anthophyllite and/or serpentine. Often minute inclusions of these alteration products can be seen within the individual crystals of talc or tremolite.

The ultramafic talc deposits of Vermont offer

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a third example of the complexities of rock formations containing asbestos minerals. The core of the untramafic bodies is often a sepentine rock derived from a hydrothermal alteration of a preexisting pyroxene and olivine-rich ultramafic rock. The serpentine core often grades outward into talc–serpentine–carbonate rock, then steatite (massive talc ore containing often small amounts of serpentine), then "blackwall" rock (contains amphiboles, chlorite, quartz, albite, etc.), and finally the country rock. Equivalent ultramafic bodies in Quebec, Canada, form some of the world's largest chrysotile deposits (chrysotile is a variety of serpentine).

From these brief descriptions of typical deposits containing amphiboles and serpentine, it should be apparent that mining of an ore, for whatever its use, free of asbestos minerals is not a simple task. The talc ores of the Gouverneur locality are used for industrial purposes—for paint fillers, ceramic materials, etc. They are not used for cosmetic products or in foods or drugs. However a scenario might be constructed that goes as follows: As the pure deposits of high grade talc, kaolinite, or expandable montmorillonite, that are used in foods and drugs, become scarcer and much more expensive, impure deposits such as those of Gouverneur might be mistakenly utilized for these purposes. One thing that geologists can do is to document the important asbestos and talc mining localities and to present a detailed study of their mineralogy, particularly the mineralogy of fine particles. Those localities that appear free of minerals that may cause health problems could be brought to the attention of interested parties. Such a positive approach to these problems I believe would be much more successful than our spending a lifetime looking at cans of talc or vials of water samples in order to tell whether a company was marketing a safe product.